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Data Article

Dataset on flue gas composition during pyrolysis of polyoxymethylene in a fluidised bed with the possibility of incorporating CO_2

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A B S T R A C T

The dataset presented in this article is the supplementary data for the research article titled "*The pyrolysis and combustion of polyoxymethylene in a fluidised bed with the possibility of incorporating CO2*" [1], in which possible paths of polyoxymethylene conversion in the fluidised bed made from cenospheres and by means of various fluidising gases (air, N_2, CO_2) were tested. The use of CO_2 as fluidising gas was particularly interesting because above 600°C its incorporation into process products (i.e. CO-rich flue gas) was observed. The gaseous products were detected using Fourier Transform Infrared Spectroscopy (FTIR, Gasmet DX-4000) at intervals of a few seconds. The data on the concentration changes over time will allow to evaluate and verificate of new kinetic models of polyoxymethylene degradation with the possibility of incorporating CO_2.

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Specifications Table

Subject	Environmental Engineering; Chemical Engineering
Specific subject area	pyrolysis, poloxymethylene pyrolysis, CO_2 incorporation
Type of data	Table
How data were acquired	The qualitative and quantitative analysis of the main gaseous products of thermal utilisation of polyoxymethylene in a CO_2 atmosphere were performed by infrared absorption spectroscopy (FT-IR, DX-4000, Gasmet Technologies).
Data format	Raw
Parameters for data collection	Determination of the concentrations of components in a multi-component mixture of flue gases were made based on the recorded infrared absorbance spectra of the mixture. The spectra were generated in the range of 900 cm^{-1} to 4200 cm^{-1}. Measurement of each spectrum and its deconvolution lasted for 7-8 seconds. The explanation of mathematical deconvolution was included in the related research article as Appendix 1.
Description of data collection	Polyoxymethylene pyrolysis was carried out in a fluidised bed reactor. The fluidised bed was made of cenospheres and CO_2 was used as fluidising medium. The bed was heated to 500-800°. The polyoxymethylene samples were dripped from the top of the reactor. The decomposing of the sample caused changes in the composition of the gases leaving the reactor. The FTIR analyser and deconvolution method (GASMET software) were used for the qualitative and quantitative analysis of the flue gases.
Data source location	Cracow University of Technology, Faculty of Chemical Engineering and Technology, Cracow, Poland
Data accessibility	Data are accessible with the article.
Related research article	Witold Żukowski, Gabriela Berkowicz, Tomasz M. Majka, The pyrolysis and combustion of polyoxymethylene in a fluidised bed with the possibility of incorporating CO_2 Energy Conversion and Management, 2020, in press [1]

Value of the data

- The data provides detail information on the quality and quantity of the gaseous products during the pyrolysis of polyoxymethylene by CO_2 in the fluidised bed made of cenospheres.
- This dataset will be helpful to develop the kinetic modesl of pyrolysis of polyoxymethylene in CO_2 atmosphere.
- This dataset will be helpful for mathematical modelling for chemical processes in fluidised bed or other types of reactors.

1. Data Description

The pyrolysis process is the subject of many works, because it is an attractive alternative to incineration for waste [2]. Studies on the pyrolysis of plastic waste are important for assembling the Circular Economy. To maximize plastic waste valorisation, it is suggested to study the recycling of each of the polymers separately. Most studies on plastic pyrolysis focus on polyolefins, PVC, PET [3]. There are only a few papers that focus on chemical recycling of polyoxymethylene [4].

This work present composition of flue gases recorded by the FTIR analyser obtained during the pyrolysis of polyoxymethylene in the atmosphere of CO_2 in a fluidised bed made of cenospheres. The waste polyoxymethylene is a source of valuable formaldehyde. However, when polyoxymethylene degradation was conducted in CO_2 atmosphere it was found that above 600°C carbon from fluidising gas can be incorporated to products of POM decomposition. That kind of polyoxymethylene recycling lead to the CO-rich feedstock that may be associated with a negative CO_2 emission, if waste CO_2 is used to react with POM instead of being emitted to the atmosphere. Such a process is particularly important from an ecological point of view. Dataset on the composition of the exhaust gases during polyoxymethylene samples decomposition in CO_2 atmosphere is useful for the further development of modelling processes with CO_2 incorpora-

Table 1
Parameters of fluidised bed reactor, bed material and fluidising medium.

	Parameter, units	Magnitude
Fluidised bed reactor	Shape	tube
	Wall material	quartz
	Inner diameter, mm	96
	Height, mm	500
	Heating	electrical
	Sieve bottom	CrNi steel plate (1 mm thick), evenly distributed holes (diam. 0.6 mm; 6.25 cm^{-2})
Fluidised bed	Material	cenospheres
	Shape	spherical
	Grain diameter, mm	0.25-0.30
	Mass, g	300
	Density, g/cm^3	845
	Static height, mm	115
	Temperature,°C	500 - 800
	Minimum fluidisation velocity, cm/s	1.24 (at 500°C) 1.13 (at 600°C) 1.04 (at 700°C)
Fluidising medium	Physical state	Gas
	Composition	CO_2
	Inlet temperature,°C	20-25
	Flow Rate, L/min @STP	30 (40 for 500°C)

tion. Numerical stimulation of chemical process is an interest of of many groups, among others, Combustion Group from University of Southern California [5], the CRECK Modeling Group from Politecnico di Milano [6], Lawrence Livermore National Laboratory [7], Combustion group from Berkeley University of California [8], The combustion research group from UC San Diego [9].

This dataset contains 5 Tables. The features of the fluidised bed reactor, bed material, and fluidising ~~air~~ gas are presented in Table 1. Tables 2-5 contain flue gas composition during thermal utilisation of polyoxymethylene in a CO2 atmosphere at different temperatures.

2. Experimental Design, Materials, and Methods

Thermal degradation of polyoxymethylene was performed in the fluidised bed reactor which was made from a quartz tube and chrome-nickel plate with evenly distributed holes. 300 g of cenospheres with diam. 0.25-0.3m mm were placed into reactor. The cenospheres were introduced into a stable fluidized state by means of a gaseous CO_2. The parameters of the reactor, bed material and fluidising gas are summarized in Table 1. Studies on fluidization of cenospheric material can be found in the paper [10].

The cenospheric bed was electrically heated to a given temperature in the range 500-800°C. At specified temperature, samples of polyoxymethylene pellets were dripped into the bed from an open space at the top of reactor. Three types of polyoxymethylene were used: pure polymer (POM-P); recyclate (POM-R), and waste polymer (POM-O). The masses of individual samples were around 200 mg. Due to low density of fluidised bed, polyoxymethylene pellets sank into the bed.

Released during degradation of polyoxymethylene sample gases were sampled by a probe and their infrared spectrum was recorded every few seconds by FTIanalyser. The deconvolution of multi-component spectra was performed using Gasmet Software, using the least squares method. Recording the spectrum with its deconvolution lasted 7-8 seconds. Concentrations of the exhaust gases resulting from the analysis components are shown in Tables 2–5.

Table 2
Composition of flue gases during thermal utilisation of polyoxymethylene in a CO_2 atmosphere at 800°C.

Temp., C [°C]	Sample	Mass [mg]	Time [s]	CO [ppm]	CH4 [ppm]	HCHO [ppm]	CH3OH [ppm]	HCOOH [ppm]	CH3COCH3 [ppm]
800	POM-P	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	396.23	27.54	2.78	0.00	0.00	0.00
			13	18711.14	401.05	65.33	6.40	0.00	0.00
			20	41211.64	625.28	157.91	16.45	0.00	0.00
			27	15355.21	414.74	76.46	10.33	0.00	0.00
			33	3745.73	169.93	22.54	9.92	0.00	0.00
			40	1010.44	54.11	7.50	5.04	0.00	0.00
			47	300.56	16.62	1.97	0.00	0.00	0.00
			54	91.72	5.63	0.90	0.00	0.00	0.00
			60	34.97	1.83	0.60	0.00	0.00	0.00
			67	17.81	0.00	0.00	0.00	0.00	0.00
			74	9.53	0.00	0.00	0.00	0.00	0.00
			81	5.99	0.00	0.00	0.00	0.00	0.00
			87	3.93	0.00	0.00	0.00	0.00	0.00
			94	4.19	0.00	0.00	0.00	0.00	0.00
			101	2.75	0.00	0.00	0.00	0.00	0.00
			108	2.80	0.00	0.00	0.00	0.00	0.00
			114	2.34	0.00	0.00	0.00	0.00	0.00
			121	1.74	0.00	0.00	0.00	0.00	0.00
			128	0.00	0.00	0.00	0.00	0.00	0.00
	POM-P	203	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	5.92	1.10	0.49	0.00	0.00	0.00
			14	9859.06	253.44	62.47	6.65	0.00	0.00
			20	43599.53	593.31	182.02	11.67	0.00	0.00
			27	28225.48	512.62	119.21	10.65	0.00	0.00
			34	7144.14	238.65	37.87	6.01	0.00	0.00
			41	1787.77	83.79	11.01	0.00	0.00	0.00
			47	527.49	24.72	3.30	0.00	0.00	0.00
			54	160.01	7.52	0.94	0.00	0.00	0.00
			61	52.83	1.96	0.00	0.00	0.00	0.00
			68	23.50	0.66	0.00	0.00	0.00	0.00
			74	14.93	0.00	0.00	0.00	0.00	0.00
			81	8.54	0.00	0.00	0.00	0.00	0.00
			88	5.88	0.00	0.00	0.00	0.00	0.00
			96	4.27	0.00	0.00	0.00	0.00	0.00
			103	2.28	0.00	0.00	0.00	0.00	0.00
			109	2.35	0.00	0.00	0.00	0.00	0.00
			116	2.81	0.00	0.00	0.00	0.00	0.00
			123	2.19	0.00	0.00	0.00	0.00	0.00
			130	2.45	0.00	0.00	0.00	0.00	0.00
	POM-R	198	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	1031.49	79.43	9.00	0.35	0.00	0.00
			14	52368.60	709.82	94.50	21.64	0.00	0.00
			20	20746.37	495.41	39.91	14.75	0.00	0.00
			27	4725.81	210.43	11.16	8.68	0.00	0.00
			34	1253.91	69.17	3.34	0.00	0.00	0.00
			41	371.24	20.97	0.54	0.00	0.00	0.00
			47	107.73	6.43	0.29	0.00	0.00	0.00
			54	38.26	1.83	0.00	0.00	0.00	0.00
			61	15.50	0.00	0.00	0.00	0.00	0.00
			68	7.91	0.00	0.00	0.00	0.00	0.00
			75	5.29	0.00	0.00	0.00	0.00	0.00
			81	3.21	0.00	0.00	0.00	0.00	0.00
			88	1.94	0.00	0.00	0.00	0.00	0.00
			95	1.42	0.00	0.00	0.00	0.00	0.00
			102	0.29	0.00	0.00	0.00	0.00	0.00

(continued on next page)

Table 2 (*continued*)

800	POM-R	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	1513.56	102.68	12.35	0.22	0.00	0.00
			14	67582.36	767.65	152.30	36.91	0.00	0.00
			21	25444.63	526.45	68.58	24.97	0.00	0.00
			27	5964.57	233.55	20.07	11.57	0.00	0.00
			34	1525.81	81.91	5.59	5.18	0.00	0.00
			41	454.53	24.45	1.04	0.00	0.00	0.00
			48	137.77	7.63	0.00	0.00	0.00	0.00
			54	53.45	2.23	0.00	0.00	0.00	0.00
			61	25.62	0.00	0.00	0.00	0.00	0.00
			68	12.16	0.00	0.00	0.00	0.00	0.00
			75	8.08	0.00	0.00	0.00	0.00	0.00
			82	5.88	0.00	0.00	0.00	0.00	0.00
			88	4.19	0.00	0.00	0.00	0.00	0.00
			95	2.74	0.00	0.00	0.00	0.00	0.00
			102	3.15	0.00	0.00	0.00	0.00	0.00
	POM-O	200	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	105.52	9.61	12.43	6.26	0.00	0.00
			13	30534.40	472.99	471.73	18.47	0.00	0.00
			20	49867.17	619.05	453.35	31.27	0.00	0.00
			27	13265.45	334.06	152.55	10.37	0.00	0.00
			33	3344.01	125.41	46.27	7.47	0.00	0.00
			40	1043.66	37.67	14.92	8.69	0.00	0.00
			47	355.43	11.26	5.52	7.51	0.00	0.00
			54	135.10	3.26	2.79	0.00	0.00	0.00
			60	59.85	1.47	1.90	0.00	0.00	0.00
			67	35.15	0.56	0.00	0.00	0.00	0.00
			74	21.40	0.00	0.00	0.00	0.00	0.00
			81	17.03	0.00	0.00	0.00	0.00	0.00
			87	9.99	0.00	0.00	0.00	0.00	0.00
			94	8.18	0.00	0.00	0.00	0.00	0.00
			101	5.08	0.00	0.00	0.00	0.00	0.00
			108	4.54	0.00	0.00	0.00	0.00	0.00
			114	3.35	0.00	0.00	0.00	0.00	0.00
			121	2.44	0.00	0.00	0.00	0.00	0.00
			128	1.97	0.00	0.00	0.00	0.00	0.00
			135	1.29	0.00	0.00	0.00	0.00	0.00
			141	0.45	0.00	0.00	0.00	0.00	0.00
	POM-O	198	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	302.76	23.90	9.86	0.00	0.00	0.00
			14	42813.83	553.72	414.32	27.66	0.00	0.00
			21	38283.70	552.09	317.08	27.25	0.00	0.00
			27	9730.84	270.92	102.81	10.56	0.00	0.00
			34	2624.01	98.61	32.44	9.72	0.00	0.00
			41	834.55	29.34	11.15	9.50	0.00	0.00
			48	291.46	7.93	3.90	0.00	0.00	0.00
			54	109.60	2.69	2.09	0.00	0.00	0.00
			61	53.48	1.05	1.46	0.00	0.00	0.00
			68	28.91	0.00	0.97	0.00	0.00	0.00
			75	17.39	0.00	1.17	0.00	0.00	0.00
			81	11.29	0.00	1.05	0.00	0.00	0.00
			88	6.41	0.00	0.00	0.00	0.00	0.00
			95	5.50	0.00	0.00	0.00	0.00	0.00
			102	2.94	0.00	0.00	0.00	0.00	0.00
			108	1.82	0.00	0.00	0.00	0.00	0.00
			115	3.98	0.00	0.00	0.00	0.00	0.00
			122	1.23	0.00	0.00	0.00	0.00	0.00
			129	0.00	0.00	0.00	0.00	0.00	0.00
			136	0.00	0.00	0.00	0.00	0.00	0.00
			142	0.00	0.00	0.00	0.00	0.00	0.00

Table 3
Composition of flue gases during thermal utilisation of polyoxymethylene in a CO_2 atmosphere at 700°C.

Temp. [°C]	Sample	Mass [mg]	Time [s]	CO [ppm]	CH4 [ppm]	HCHO [ppm]	CH3OH [ppm]	HCOOH [ppm]	CH3COCH3 [ppm]
700	POM-P	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	234.27	17.02	24.95	0.00	0.00	0.00
			13	15490.34	389.59	331.57	26.44	0.00	0.00
			20	43154.60	660.84	1044.66	112.56	0.00	0.00
			27	25146.90	569.05	649.39	70.61	0.00	0.00
			33	6462.63	270.01	213.05	21.23	0.00	0.00
			40	1717.58	95.59	65.36	1.92	0.00	0.00
			47	551.98	28.34	20.67	0.00	0.00	0.00
			54	195.88	9.98	7.56	0.00	0.00	0.00
			60	78.26	3.51	3.26	0.00	0.00	0.00
			67	37.85	0.97	1.77	0.00	0.00	0.00
			74	27.43	1.18	1.36	0.00	0.00	0.00
			81	13.25	0.48	0.00	0.00	0.00	0.00
			87	10.08	0.00	0.00	0.00	0.00	0.00
			94	6.34	0.00	0.00	0.00	0.00	0.00
			101	5.82	0.00	0.00	0.00	0.00	0.00
			108	4.61	0.00	0.00	0.00	0.00	0.00
			114	3.81	0.00	0.00	0.00	0.00	0.00
			121	3.32	0.00	0.00	0.00	0.00	0.00
			128	2.64	0.00	0.00	0.00	0.00	0.00
			135	2.39	0.00	0.00	0.00	0.00	0.00
			141	1.94	0.00	0.00	0.00	0.00	0.00
	POM-P	203	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	38.71	2.12	8.80	0.00	0.00	0.00
			13	8284.30	241.21	352.33	17.90	0.00	0.00
			20	37694.64	617.27	1275.90	115.51	0.00	0.00
			27	29671.66	612.54	906.67	88.80	0.00	0.00
			33	8437.51	319.48	316.12	27.65	0.00	0.00
			40	2183.80	119.72	99.89	12.02	0.00	0.00
			47	710.07	37.71	32.29	0.97	0.00	0.00
			54	259.83	10.80	11.36	0.00	0.00	0.00
			61	105.30	3.50	4.25	0.00	0.00	0.00
			67	48.79	1.09	2.60	0.00	0.00	0.00
			74	26.20	0.00	0.00	0.00	0.00	0.00
			81	18.12	0.00	0.00	0.00	0.00	0.00
			88	10.73	0.00	0.00	0.00	0.00	0.00
			95	8.35	0.00	0.00	0.00	0.00	0.00
			102	6.62	0.00	0.00	0.00	0.00	0.00
			108	4.39	0.00	0.00	0.00	0.00	0.00
			115	6.92	0.00	0.00	0.00	0.00	0.00
			122	3.84	0.00	0.00	0.00	0.00	0.00
			129	5.45	0.00	0.00	0.00	0.00	0.00
			135	2.19	0.00	0.00	0.00	0.00	0.00
	POM-R	203	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	2.96	0.58	0.32	0.00	0.00	0.00
			13	777.63	60.60	129.70	2.93	0.00	0.00
			20	41669.05	712.39	893.33	128.95	0.00	0.00
			27	25282.22	593.56	497.03	80.64	0.00	0.00
			33	6248.28	282.31	161.17	24.91	0.00	0.00
			40	1733.66	101.82	48.67	4.03	0.00	0.00
			47	598.49	30.58	15.93	1.04	0.00	0.00
			54	225.55	9.68	5.95	0.00	0.00	0.00
			60	97.61	3.41	2.64	0.00	0.00	0.00
			67	50.07	1.13	1.55	0.00	0.00	0.00
			74	27.94	0.00	0.00	0.00	0.00	0.00
			81	16.27	0.00	0.00	0.00	0.00	0.00
			87	11.68	0.00	0.00	0.00	0.00	0.00
			94	7.28	0.00	0.00	0.00	0.00	0.00
			101	5.59	0.00	0.00	0.00	0.00	0.00
			108	4.68	0.00	0.00	0.00	0.00	0.00
			115	3.23	0.00	0.00	0.00	0.00	0.00
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 3 (*continued*)

700	POM-R	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	45.14	5.04	11.45	0.00	0.00	0.00
			13	28531.70	582.57	689.19	106.08	0.00	0.00
			20	33267.88	669.24	585.59	112.69	0.00	0.00
			27	8573.08	348.64	197.55	39.71	0.00	0.00
			33	2283.42	132.06	59.39	14.46	0.00	0.00
			40	740.65	39.75	18.53	7.89	0.00	0.00
			47	263.95	12.19	6.03	0.00	0.00	0.00
			54	106.85	3.16	2.95	0.00	0.00	0.00
			60	54.87	1.09	1.08	0.00	0.00	0.00
			67	30.37	0.00	0.00	0.00	0.00	0.00
			74	20.15	0.00	0.00	0.00	0.00	0.00
			81	12.84	0.00	0.00	0.00	0.00	0.00
			87	9.26	0.00	0.00	0.00	0.00	0.00
			94	7.23	0.00	0.00	0.00	0.00	0.00
			101	6.48	0.00	0.00	0.00	0.00	0.00
			108	4.87	0.00	0.00	0.00	0.00	0.00
			114	3.73	0.00	0.00	0.00	0.00	0.00
			121	2.39	0.00	0.00	0.00	0.00	0.00
			128	3.01	0.00	0.00	0.00	0.00	0.00
			135	0.91	0.00	0.00	0.00	0.00	0.00
			141	0.00	0.00	0.00	0.00	0.00	0.00
	POM-O	199	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	275.86	16.12	51.60	0.00	0.00	0.00
			13	21456.45	408.89	1388.85	76.46	0.00	0.00
			20	36253.03	602.28	1804.23	115.58	0.00	0.00
			27	10674.01	333.96	676.33	38.83	0.00	0.00
			33	2996.19	130.93	221.51	12.95	0.00	0.00
			40	1067.77	41.35	71.40	6.48	0.00	0.00
			47	486.11	12.42	25.02	4.63	0.00	0.00
			54	302.04	4.08	9.57	4.82	0.00	0.00
			60	209.60	1.41	4.60	5.77	0.00	0.00
			67	140.67	1.13	2.80	3.42	0.00	0.00
			75	99.23	0.00	2.07	0.00	0.00	0.00
			82	78.36	0.00	0.00	0.00	0.00	0.00
			89	63.82	0.00	0.00	0.00	0.00	0.00
			96	45.06	0.00	0.00	0.00	0.00	0.00
			102	36.50	0.00	0.00	0.00	0.00	0.00
			109	28.31	0.00	0.00	0.00	0.00	0.00
			116	23.25	0.00	0.00	0.00	0.00	0.00
			123	21.54	0.00	0.00	0.00	0.00	0.00
			129	17.69	0.00	0.00	0.00	0.00	0.00
			136	16.41	0.00	0.00	0.00	0.00	0.00
			143	15.46	0.00	0.00	0.00	0.00	0.00
			150	10.82	0.00	0.00	0.00	0.00	0.00
			156	12.11	0.00	0.00	0.00	0.00	0.00
			163	7.40	0.00	0.00	0.00	0.00	0.00
			170	6.68	0.00	0.00	0.00	0.00	0.00
	POM-O	200	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	4178.22	127.69	477.00	14.44	0.00	0.00
			14	32889.40	556.34	2132.45	127.17	0.00	0.00
			20	17118.87	441.96	1148.24	48.43	0.00	0.00
			27	4658.25	197.28	396.87	21.98	0.00	0.00
			34	1464.79	64.32	127.90	9.44	0.00	0.00
			41	586.56	19.88	42.59	6.91	0.00	0.00
			48	273.65	6.31	16.34	4.75	0.00	0.00
			54	190.61	2.10	6.73	7.53	0.00	0.00
			61	141.47	0.00	3.63	0.00	0.00	0.00
			68	118.09	0.00	1.58	0.00	0.00	0.00
			75	88.42	0.00	1.14	0.00	0.00	0.00
			81	64.29	0.00	1.29	0.00	0.00	0.00
			88	52.71	0.00	0.00	0.00	0.00	0.00
			95	39.29	0.00	0.00	0.00	0.00	0.00
			102	33.98	0.00	0.00	0.00	0.00	0.00

Table 4
Composition of flue gases during thermal utilisation of polyoxymethylene in a CO_2 atmosphere at 600°C.

Temp.	Sample	Mass	Time	CO	CH4	HCHO	CH3OH	HCOOH	CH3COCH3
[°C]		[mg]	[s]	[ppm]					
600	POM-P	204	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	9.85	0.00	9.41	0.00	0.00	0.00
			14	2381.80	120.53	851.42	66.82	5.04	6.15
			21	11682.76	468.70	2256.72	314.20	12.75	23.10
			27	19950.90	489.55	4287.01	465.66	16.21	31.73
			34	11889.11	505.61	1963.91	214.53	12.46	17.75
			41	3605.98	237.87	729.79	71.66	4.78	3.32
			48	1082.04	83.75	236.22	24.91	3.21	0.83
			54	391.65	24.43	76.92	4.42	2.99	0.00
			61	168.20	6.89	26.79	0.55	2.85	0.00
			68	84.23	2.02	12.05	0.28	1.83	0.00
			75	50.72	0.00	7.48	0.34	1.34	0.00
			82	37.61	0.00	5.02	0.00	0.00	0.00
			88	29.06	0.00	3.87	0.00	0.00	0.00
			95	23.35	0.00	3.33	0.00	0.00	0.00
			102	18.40	0.00	0.00	0.00	0.00	0.00
			110	13.93	0.00	0.00	0.00	0.00	0.00
			116	10.94	0.00	0.00	0.00	0.00	0.00
			123	12.60	0.00	0.00	0.00	0.00	0.00
			130	10.80	0.00	0.00	0.00	0.00	0.00
			137	6.79	0.00	0.00	0.00	0.00	0.00
			144	4.52	0.00	0.00	0.00	0.00	0.00
			150	3.93	0.00	0.00	0.00	0.00	0.00
	POM-P	205	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	138.76	5.22	101.03	0.00	0.00	0.00
			14	4526.83	205.49	1137.32	85.73	5.64	7.95
			20	13837.48	495.19	2798.82	326.44	12.05	27.21
			27	15963.47	566.65	3804.14	369.12	11.43	32.42
			34	10608.48	422.59	2230.95	224.85	11.49	21.75
			41	4577.51	230.87	1030.37	79.85	5.63	6.11
			47	1529.59	85.09	360.46	29.87	3.34	0.74
			54	524.90	25.42	119.56	6.28	2.54	0.00
			61	215.55	7.53	42.36	2.36	2.51	0.00
			68	106.47	2.44	16.83	0.33	2.59	0.00
			74	67.05	0.00	8.36	0.00	0.00	0.00
			81	47.24	0.00	5.19	0.00	0.00	0.00
			88	35.34	0.00	4.34	0.00	0.00	0.00
			95	28.61	0.00	3.79	0.00	0.00	0.00
			101	27.00	0.00	2.37	0.00	0.00	0.00
			108	20.25	0.00	2.56	0.00	0.00	0.00
			115	15.11	0.00	2.54	0.00	0.00	0.00
			122	12.07	0.00	1.76	0.00	0.00	0.00
			128	10.66	0.00	1.46	0.00	0.00	0.00
			135	8.90	0.00	1.40	0.00	0.00	0.00
			142	7.10	0.00	1.18	0.00	0.00	0.00
			149	5.31	0.00	1.35	0.00	0.00	0.00
			155	3.80	0.00	1.34	0.00	0.00	0.00
	POM-R	199	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	2.39	0.00	2.08	0.00	0.00	0.00
			13	4873.10	210.68	949.76	121.22	4.08	6.99
			20	26449.96	348.70	4499.24	511.07	8.83	26.32
			27	12247.27	554.56	1973.44	218.51	10.28	13.16
			34	3960.81	283.13	760.34	83.04	3.06	3.35
			41	1275.77	105.04	250.90	18.81	2.26	0.00
			47	477.84	31.28	81.10	5.16	2.13	0.00
			54	235.67	9.71	27.44	2.20	1.73	0.00
			61	130.06	3.16	11.66	0.00	0.07	0.00
			68	83.50	1.03	6.57	0.00	0.00	0.00
			74	63.29	0.64	3.91	0.00	0.00	0.00
			81	47.76	0.00	3.81	0.00	0.00	0.00
			88	42.98	0.00	2.59	0.00	0.00	0.00
			95	33.83	0.00	2.36	0.00	0.00	0.00
			101	26.98	0.00	0.00	0.00	0.00	0.00
			108	25.10	0.00	0.00	0.00	0.00	0.00
			115	21.06	0.00	0.00	0.00	0.00	0.00
			122	18.46	0.00	0.00	0.00	0.00	0.00

Table 4 (*continued*)

600	POM-R	207	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	2143.64	100.68	539.55	48.34	2.85	5.22
			13	26523.34	338.84	4727.21	554.95	9.47	28.07
			20	13257.65	571.12	2099.95	265.87	11.48	15.39
			27	3872.47	281.21	764.91	82.92	4.12	1.61
			33	1202.91	103.42	250.96	19.27	2.56	0.00
			40	479.19	30.66	79.52	5.98	3.43	0.00
			47	223.55	9.63	27.96	2.26	2.52	0.00
			54	126.74	2.38	11.40	0.49	2.04	0.00
			60	90.40	0.76	5.46	0.00	0.00	0.00
			67	60.46	0.00	3.81	0.00	0.00	0.00
			74	48.47	0.00	2.94	0.00	0.00	0.00
			81	41.93	0.00	2.50	0.00	0.00	0.00
			87	33.57	0.00	1.95	0.00	0.00	0.00
			94	29.13	0.00	1.35	0.00	0.00	0.00
			101	23.28	0.00	2.09	0.00	0.00	0.00
			108	19.95	0.00	1.80	0.00	0.00	0.00
			115	17.28	0.00	0.00	0.00	0.00	0.00
			121	14.37	0.00	0.00	0.00	0.00	0.00
			128	10.85	0.00	0.00	0.00	0.00	0.00
			135	8.03	0.00	0.00	0.00	0.00	0.00
			142	6.99	0.00	0.00	0.00	0.00	0.00
			148	7.11	0.00	0.00	0.00	0.00	0.00
			155	6.52	0.00	0.00	0.00	0.00	0.00
	POM-O	198	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	642.30	19.63	295.67	4.11	1.51	0.00
			14	10820.56	282.46	3192.21	181.36	4.33	27.77
			21	16938.90	655.17	6059.16	280.61	4.31	33.93
			27	6040.58	268.30	1860.75	85.25	6.54	9.91
			34	1777.32	105.41	650.23	29.21	4.09	3.03
			41	623.29	33.36	216.53	12.55	2.54	0.00
			48	258.26	10.34	74.50	7.71	2.42	0.00
			54	139.16	2.31	28.37	0.00	0.00	0.00
			61	101.91	0.00	12.15	0.00	0.00	0.00
			68	80.10	0.00	7.89	0.00	0.00	0.00
			75	69.28	0.00	5.28	0.00	0.00	0.00
			81	56.22	0.00	4.28	0.00	0.00	0.00
			88	48.50	0.00	4.23	0.00	0.00	0.00
			95	41.54	0.00	3.89	0.00	0.00	0.00
			102	38.90	0.00	0.00	0.00	0.00	0.00
			108	39.15	0.00	0.00	0.00	0.00	0.00
			115	35.47	0.00	0.00	0.00	0.00	0.00
			122	34.90	0.00	0.00	0.00	0.00	0.00
			129	33.34	0.00	0.00	0.00	0.00	0.00
			135	29.72	0.00	0.00	0.00	0.00	0.00
			142	23.05	0.00	0.00	0.00	0.00	0.00
			149	20.45	0.00	0.00	0.00	0.00	0.00
			156	17.14	0.00	0.00	0.00	0.00	0.00

Table 5
Composition of flue gases during thermal utilisation of polyoxymethylene in a CO_2 atmosphere at 500°C.

Temp.	Sample	Mass	Time	CO	CH4	HCHO	CH3OH	HCOOH	CH3COCH3
[°C]		[mg]	[s]	[ppm]					
500	POM-P	203	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	12.11	0.00	41.95	0.00	0.04	0.00
			13	315.73	0.00	1008.71	38.39	3.49	0.36
			20	3254.08	187.31	3916.52	474.78	9.77	27.92
			27	5114.56	416.76	5409.35	931.94	15.33	29.33
			33	4327.85	396.18	4739.63	782.99	18.10	24.26
			40	2531.91	194.87	1792.96	289.69	9.59	6.75
			47	884.37	76.09	653.41	99.72	5.01	1.10
			54	317.78	23.31	216.30	24.10	4.60	0.00
			60	121.57	7.92	72.22	7.93	4.03	0.00
			67	55.93	3.08	28.50	2.29	2.54	0.00
			74	31.35	1.56	13.52	0.72	2.53	0.00
			81	20.83	0.66	8.07	0.35	2.49	0.00
			88	15.40	0.00	5.95	0.00	0.00	0.00
			94	11.90	0.00	4.21	0.00	0.00	0.00
			101	11.65	0.00	3.38	0.00	0.00	0.00
			108	9.90	0.00	3.35	0.00	0.00	0.00
			115	8.99	0.00	2.21	0.00	0.00	0.00
			121	7.74	0.00	0.00	0.00	0.00	0.00
			128	7.38	0.00	0.00	0.00	0.00	0.00
			135	6.32	0.00	0.00	0.00	0.00	0.00
			142	6.35	0.00	0.00	0.00	0.00	0.00
	POM-P	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	105.89	0.51	377.79	5.84	2.62	0.00
			14	1199.16	68.72	2280.15	182.99	4.32	23.26
			20	3393.21	310.76	5519.35	660.79	11.55	36.97
			27	3538.66	317.22	6668.24	816.39	12.80	37.54
			34	2280.69	269.18	5313.23	619.59	17.15	31.37
			41	1334.56	111.01	1729.66	208.73	7.86	12.68
			47	471.38	39.81	613.96	74.91	4.50	3.02
			54	171.47	12.44	202.95	16.89	3.82	0.00
			61	75.06	4.32	67.08	6.18	3.40	0.00
			68	39.67	0.66	24.79	2.45	2.90	0.00
			74	27.03	0.00	10.22	0.63	2.69	0.00
			81	18.05	0.00	4.43	0.00	0.00	0.00
			88	13.92	0.00	2.29	0.00	0.00	0.00
			95	10.69	0.00	1.25	0.00	0.00	0.00
			101	9.16	0.00	0.00	0.00	0.00	0.00
			108	6.97	0.00	0.00	0.00	0.00	0.00
			115	5.87	0.00	0.00	0.00	0.00	0.00
			122	4.49	0.00	0.00	0.00	0.00	0.00
			128	3.48	0.00	0.00	0.00	0.00	0.00
			135	2.52	0.00	0.00	0.00	0.00	0.00
			142	1.68	0.00	0.00	0.00	0.00	0.00
			149	0.00	0.00	0.00	0.00	0.00	0.00
			155	0.00	0.00	0.00	0.00	0.00	0.00
	POM-O	203	0	0.00	0.00	0.00	0.00	0.00	0.00
			7	12.92	0.07	61.37	0.00	0.00	0.17
			14	288.89	20.45	1318.56	35.56	4.39	0.93
			20	1658.54	88.64	6457.87	294.89	5.15	33.08
			27	1779.61	112.51	9076.81	415.65	71.43	18.20
			34	1820.21	83.66	5875.71	231.12	5.09	6.58
			41	614.49	37.23	1687.02	73.41	5.62	3.14
			47	280.41	15.67	608.58	26.90	4.44	0.00
			54	107.90	4.25	205.47	14.84	2.70	0.00
			61	57.96	1.67	72.35	2.09	3.47	0.00
			68	36.38	0.26	29.45	0.00	0.00	0.00
			74	27.01	0.00	15.27	0.00	0.00	0.00
			81	23.32	0.00	9.39	0.00	0.00	0.00
			88	19.26	0.00	7.52	0.00	0.00	0.00
			95	18.35	0.00	7.49	0.00	0.00	0.00
			101	14.06	0.00	5.01	0.00	0.00	0.00
			108	14.10	0.00	4.58	0.00	0.00	0.00
			115	13.34	0.00	3.61	0.00	0.00	0.00
			122	11.77	0.00	3.35	0.00	0.00	0.00
			128	9.93	0.00	3.05	0.00	0.00	0.00
			135	9.63	0.00	2.68	0.00	0.00	0.00

Table 5 (*continued*)

500	POM-O	201	0	0.00	0.00	0.00	0.00	0.00	0.00
			6	10.69	0.50	49.65	0.00	0.00	0.00
			13	299.34	24.87	1165.05	32.47	5.42	12.34
			20	1734.43	82.67	6878.80	267.54	5.83	30.22
			27	2118.44	119.56	9537.80	308.20	82.35	14.28
			34	1688.37	70.00	4760.22	187.90	9.43	1.68
			40	618.52	16.41	1333.04	52.71	6.23	0.00
			47	212.56	7.29	465.64	20.10	4.78	0.00
			54	86.97	2.57	157.11	13.20	3.60	0.00
			61	46.15	0.00	57.86	0.57	3.67	0.00
			67	32.82	0.00	25.46	7.37	3.55	0.00
			74	23.37	0.00	14.44	6.75	3.53	0.00
			81	20.37	0.00	9.76	0.00	0.00	0.00
			88	14.66	0.00	6.26	0.00	0.00	0.00
			95	13.89	0.00	5.19	0.00	0.00	0.00
			102	11.87	0.00	4.74	0.00	0.00	0.00
			108	9.87	0.00	5.24	0.00	0.00	0.00
			115	9.56	0.00	4.03	0.00	0.00	0.00
			122	9.01	0.00	3.16	0.00	0.00	0.00
			129	6.77	0.00	0.00	0.00	0.00	0.00
			135	8.17	0.00	0.00	0.00	0.00	0.00
			142	5.14	0.00	0.00	0.00	0.00	0.00
			149	5.32	0.00	0.00	0.00	0.00	0.00
			156	4.36	0.00	0.00	0.00	0.00	0.00
			162	3.81	0.00	0.00	0.00	0.00	0.00
			169	3.80	0.00	0.00	0.00	0.00	0.00
			176	3.13	0.00	0.00	0.00	0.00	0.00
			183	3.27	0.00	0.00	0.00	0.00	0.00

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.105703.

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